

Discussions on taxonomy of genus *Betula* in northeast China

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Abstract Many researches have been carried out on the taxonomy of *Betula* in northeast of China, but the classification of species and subdivision of species had some divergences at all times, which led to a disorder for developing and utilizing resources of *Betula*. In this paper, species and subdivision of *Betula* were classified not only according to the wax sample of *Betula* but also the comprehensive taxonomy of population characters, geographical distribution, and the habitat. The conclusion supported the Fu Pei-yuns' (1995) viewpoint of the taxonomy of *Betula* in the northeast of China. But *B. mandshurica* (Regel) Nakai should be considered as one single species, the name of *B. platyphylla* Suk. var *phellodendroides* Tung should be the synonym of *B. platyphylla* var *platyphylla*, and *B. ermanii* Cham. var. *yingkiliensis* liou et Wang should be incorporated into *B. ermanii* Cham. *B. ovalifolia* Rupr should not be regarded as a variety of *B. fruticosa* Pall. but as one single species.

Keywords: Taxonomy; *Betula*; Northeast forest region

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Introduction

Northeast forestry region includes Heilongjiang, Jilin, Liaoning provinces, and Inner Mongolia Autonomous region. The total forested area of this region is 3.768×10^7 hm², accounting for 32.7% of total forested area of China, with a forest coverage rate of 30.4%, and timber-volume is 3.26×10^{10} m³, accounting for 35% of the total of forest volume of China. Birch is a typical light demanding trees species and can quickly occupy the open habitat. It is an important resource of northeast of China. Each species of *Betula* has formed specific morphological characteristics because of the overlapping of mountains and flat ground and the complication of the terrain and habitat. Thus many researches were carried out on the *Betula* taxonomy and the comprehensive development and utilization of birch wood. Since 1907, many studies on the taxonomy of *Betula* have been reported (Noda1971; Kuang 1979; Fu 1995; Chou 1986; Li 1988; Li 1991; Ma 1985; Komarov 1927; Kitagawa 1979; Hara 1937; Rehder 1939; Janson 1962). These studies mainly focused on the morphological difference of birch and were thought as a base of the classical plant taxonomy, but the description and subdivision of *Betula* species diverged from each other (see Table 1). As a result, it led to a disorder for comprehensive developing and utilizing resource of *Betula* tree species.

The former taxonomy of *Betula* commonly used the types, wax sample, and original record, and less attention was paid to individual and population. Up to now, there has

not been a powerful, reliable, quantifiable standard for classifying the species of *Betula*, and the typical morphological characteristics formed by species of *Betula* and its habitat during their long evolution have not been found. Furthermore, the methods of chemical taxonomy and molecular system analysis have not been adopted on taxonomy of *Betula*.

In this paper, species and subdivision of species of *Betula* were classified not only depending on the wax sample but also basing on the comprehensive taxonomy of population characters, geographical distribution, and the habitat.

Discussions

We made a long-term observation for population morphological characteristics of each species of *Betula* in different habitats and different geographical regions. By colligating, inducting, and classifying the characteristics of population and combining with wax sample, we identified and determined the species and subdivision of *Betula*. Our conclusion basically supported Fu Peiyun's (1995) viewpoint of the taxonomy of *Betula* in northeast of China, but the taxonomy of the following species should be further discussed.

1. *B. mandshurica* (Regel) Nakai should not be regarded as a variety of, or belong to, *B. platyphylla* Suk. but as a single species. Fig.1 shows the tree shape and morphological characters of *B. mandshurica* (Regel) Nakai and *B. platyphylla* Suk.. *B. platyphylla* Suk. is an explosive wide-spread pioneer tree species. It has wider ecological diversity and stronger ability of sexual and asexual reproduction. When the natural forest was destroyed, *B. platyphylla* Suk. became the dominant species of secondary woodland. Its morphological character is complicated and distinctive. The

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population of *B. platyphylla* Suk. which usually grows in lower meadow develops to a new single *B. mandshurica* (Regel) Nakai population. The new population has obvious

difference from the original *B. platyphylla* Suk. in the morphological characteristics of reproduction organ and vegetative organs and habitat (see Table 2).

Table 1. Statistic of "species" of *Betula* recorded in the monograph.

Species	Komarov (1927)	Liou (1955)	Noda (1971)	Kitagawa (1979)	Fu (1995)
<i>Betula albo-sinensis</i> Burk					+
<i>Betula ceratoptera</i> G.H.Liu et Ma					+
<i>Betula chinensis</i> Maxim.	+	+	+	+	+
<i>Betula chinensis</i> Maxim. var. <i>nana</i> Liou		+			
<i>Betula chinensis</i> Maxim. f. <i>linearisquama</i> Hatusima				+	
<i>Betula chinensis</i> Maxim. f. <i>nana</i> (Liou) Kitagawa				+	
<i>Betula costata</i> Trautv.	+	+	+	+	+
<i>Betula costata</i> Trautv. var. <i>cuneifolia</i> Kitagawa				+	
<i>Betula davurica</i> Pall.	+	+	+	+	+
<i>Betula davurica</i> Pall. var. <i>oblongifolia</i> Liou		+			
<i>Betula davurica</i> Pall. var. <i>ovalifolia</i> Liou		+			
<i>Betula davurica</i> Pall. var. <i>Tiliaefolia</i> Liou		+			
<i>Betula ermanii</i> Cham.	+	+	+	+	+
<i>Betula ermanii</i> Cham. var. <i>incisa</i> Koidz.		+			
<i>Betula ermanii</i> Cham. var. <i>lanata</i> Regel		+		+	
<i>Betula ermanii</i> Cham. var. <i>macrostrobila</i> Liou		+			
<i>Betula ermanii</i> Cham. var. <i>yingkiliensis</i> Liou et Wang		+			+
<i>Betula exilis</i> Suk.				+	+
<i>Betula fruticosa</i> Pall.	+	+	+	+	+
<i>Betula fruticosa</i> Pall. subsp. <i>gmelinii</i> (Bunge) Kitagawa				+	
<i>Betula fruticosa</i> Pall. subsp. <i>ruptechniana</i> (Trautv.) Kitagawa			+	+	
<i>Betula fruticosa</i> Pall. var. <i>ruprechtiana</i> Trautv.					+
<i>Betula fruticosa</i> Pall. var. <i>fusenensis</i> (Nakai) Liou		+			
<i>Betula gmelinii</i> Bunge		+			+
<i>Betula gmelinii</i> Bunge var. <i>zyzyphifolia</i> (C.Wang et Tung) G.H.Liu et Ma					+
<i>Betula humilis</i> Schrank					+
<i>Betula latifolia</i> Tausch.	+				
<i>Betula liaotungensis</i> Bar.		+			
<i>Betula mandshurica</i> (Regel) Nakai		+		+	
<i>Betula middendorffii</i> Trautv. et Mey.	+	+	+	+	+
<i>Betula ovalifolia</i> Rupr.		+			
<i>Betula paishanensis</i> Nakai				+	
<i>Betula platyphylla</i> Suk.		+	+	+	+
<i>Betula platyphylla</i> Suk. subsp. <i>mandshurica</i> (Regel) Kitagawa			+		
<i>Betula platyphylla</i> Suk. var. <i>phellodendroides</i> Tung					+
<i>Betula schmidtii</i> Regel	+	+	+	+	+
<i>Betula utilis</i> D. Don					+

Table 2. Contrast of morphological character and habitat of *B. mandshurica* (Regel) Nakai and *B. platyphylla* Suk.

Species	Leaf base	Infructescence	Habitat
<i>B. platyphylla</i> Suk.	Light heart; Flat cuneate	Length: 2.2-3.0 cm; Width: >0.7 cm	Mountain slope
<i>B. mandshurica</i> (Regel) Nakai	Broad cuneate; Narrow cuneate	Length: 3.6-4.0 cm; Width: <0.7 cm	Lower meadow; Flat land

2. *B. platyphylla* Suk. var. *phellodendroides* Tung should not be classified as a variety of the *B. platyphylla* Suk.. The specie name of *B. platyphylla* Suk var. *phellodendroides* Tung should be cancelled. The taxonomical characters of this species are described as follows: smooth bark, thick gray phellem, longitudinal split, dysgonic or congested velus hair on leaf stalk and leaf margin and the back leaf vein, no glandular opaque spot on each side of a leaf, broad cuneate leaf base. According to the characters above men-

tioned, we investigated about one hundred trees of *B. platyphylla* Suk. in Daxing'an Mountains. Although these trees also had cambia, it is not the original character of this birch stem. This tree suffered from the ground fire, which

led to cambia growth. Most of young leaves and lower part of blade, in particular the young leaf of *B. platyphylla* Suk. developed by asexual reproduction has setose trichomes. The setose trichomes will drop down as leaf growth.

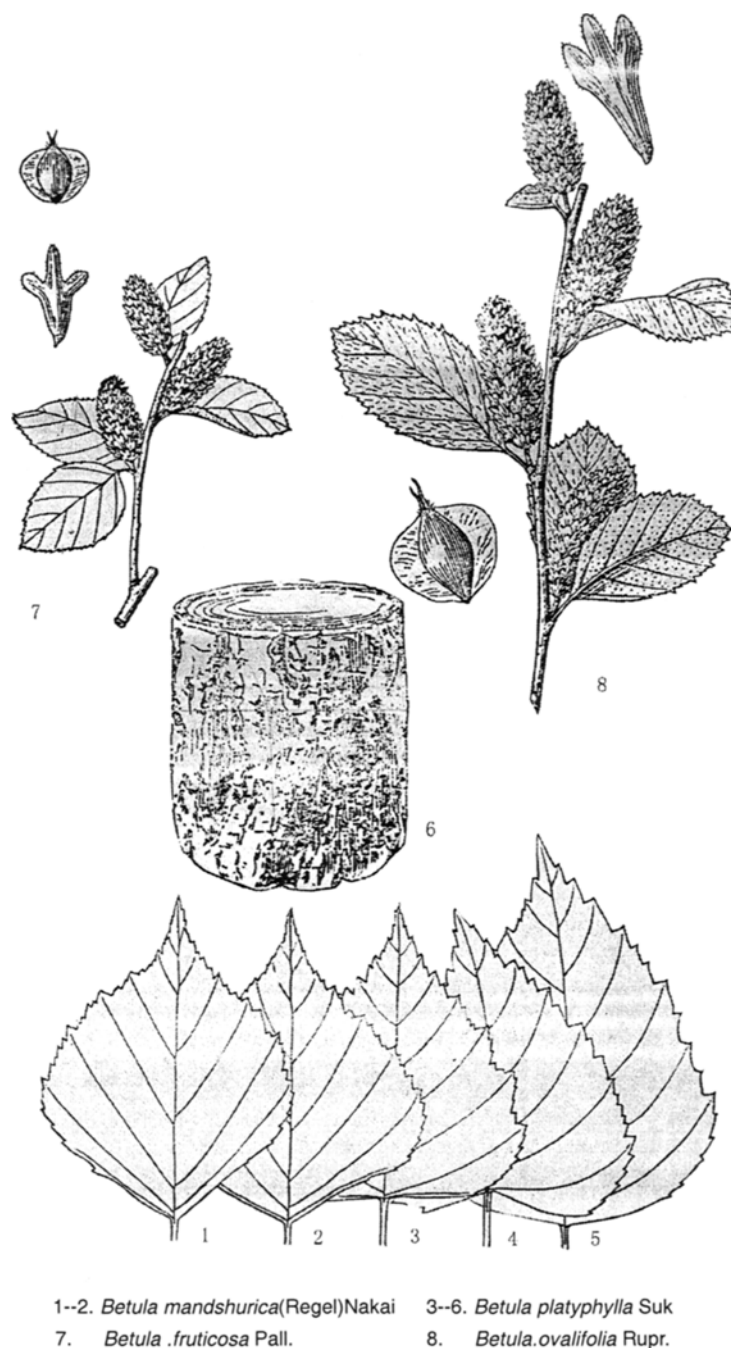


Fig.1 Morphological characters of *Betula* in northeast of China

3. *B. davurica* Pall should not be subdivided. The former of subdivision of this species see Table 3. The differences in morphological characters between *B. davurica* Pall. f. *oblongifolia* Liou, *B. davurica* Pall. f. *tiliaefolia* Liou, and *B. davurica* Pall. f. *ovalifolia* Liou reflected the difference in morphological characters of interspecies population and in

habitats. *B. davurica* Pall. mainly grows on hill top, sunny slope of mid hill, and dry land and mixes with *Quercus mongolia* Fisch et. Turcz. The thickness and nutrient conditions of soil have difference in different place, which lead to the difference of leaf morphology. Since this difference of morphology cannot inherit, it is not proper to classify sub-

division of *B. davurica* Pall.

Table 3. Typical characteristics of *B. davurica* Pall. f. *oblongifolia* Liou, *B. davurica* Pall. f. *tiliaefolia* Liou, and *B. davurica* Pall. f. *ovalifolia* Liou

<i>B. davurica</i> Pall. f. <i>oblongifolia</i> Liou	<i>B. davurica</i> Pall. f. <i>tiliaefolia</i> Liou	<i>B. davurica</i> Pall. f. <i>ovalifolia</i> Liou
Leaf prolate spheroidal; Small character long round; Lance-shape; 4.5-6.5×2-4 cm; Leaf base round or cuneate;	Leaf broad ovate; Leaf margin rough crenate	Leaf ovate; Small; 2.5-4×2-4.5 cm or 3.5-8×2-5 cm, Leaf base round

4. *B. ermanii* Cham. var. *Yingkiliensis* Liou et Wang should not be regarded as a variety. It should be incorporated into *B. ermanii* Cham. The typical morphological characters of *B. ermanii* Cham. var. *Yingkiliensis* Liou et Wang leaf are as follows: infructescence is roundness, bigger, with a long petiole of more than 1 cm; branch of fruit, both sides of leaf, and petiole have setose trichomes; extremitas of leaf is sharp-tipped; no acuminata. These characters were used to identify *B. ermanii* Cham. var. *Yingkiliensis* Liou et wang as a variety. According to our investigation, all above characters have marked difference in morphology in the *B. ermanii* Cham. population, even

though in the same plant.

5. *B. ovalifolia* Rupr should not be regarded as a variety of *B. fruticosa* Pall. but as a single species. *B. ovalifolia* Rupr and *B. fruticosa* Pall. have significant differences in the morphological characters of leaf and fruit and in geographical distribution. The viewpoint of Kuang Keren and Li Peiqiong (1979) thought *B. ovalifolia* Rupr. was an independent species are correct (see Table 4). According to the characters of shape, differences in reproductive and vegetative organs, and geographical distribution, *B. fruticosa* Pall. and *B. ovalifolia* Rupr. should be considered as different species.

Table 4. The characteristics of *B. fruticosa* Pall. and *B. ovalifolia* Rupr.

Species	Leaf shape	Fruit shape	Distribution
<i>B. fruticosa</i> Pall.	Gypseus back, no hair or little hair on vein, no glandular spot or inconspicuous glandular spot	Short extended fruitage lobe	North of Daxing'an Mountains and Xiaoxing'an Mountains
<i>B. ovalifolia</i> Rupr.	Green white back, dense hair, conspicuous glandular spot	Short erect fruitage lobe	East and North of Xiaoxing'an Mountains

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